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swims about again until it finally escapes." The reviewer did not state that the flagellum is retracted[4] when the amoeboid movements take place and does not regard it as at all likely that such is the case.

GRIGGS places the organism in the Olpideaceae, and states that it may be separated at once from all other genera of this family by its habitat. "All the other genera are parasites of aquatic plants or animals except Asterocystis, which infests the roots of the seed plants." He has probably overlooked certain species of Olpidium. *O. brassicae* (Wor.[5]) Dang.,[6] a typical Olpidium, is parasitic in the stems of cabbage seedlings. *O. simulans* (DeBary and Wor.[7]) Dang.[8] (see also A. FISCHER[9]) is parasitic in young leaves of *Taraxacum officinale* and is associated with *Synchytrium taraxaci*. SCHROETER[10] is inclined to believe this is a Pleolpidium, but it would still be a member of the Olpidiaceae. *Olpidium trifolii* (Pass.[11]) SCHROETER[12] on petioles and leaf blades of *Trifolium repens* is more doubtful; A. FISCHER[13] thinks it is a Synchytrium.

It is unfortunate that the author did not compare his organism with the genus *Reesia* Fisch[14] (pp. 8–17), since until we know more about the dehiscence of the zoosporangium and the form of the active zoospores, it would seem more reasonable to place it in this genus than to create a new one, largely hypothetical; for if the zoosporangia develop exit tubes and the zoospores are uniciliate, which is not unlikely, it would be a true Reesia.—GEO. F. ATKINSON.

Morphology of the grass flower.—SCHUSTER[15] has recently made extended investigations upon the structure and morphology of the flowers and spikelets of grasses. His results are based upon an examination of fresh and alcoholic material, with special reference to the developmental history of the parts. By means of dissections and microtome sections of spikelets in various stages of growth, he arrives at what are represented to be definite conclusions concerning certain species in twenty-five genera. Among his results the following are of special interest:

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[4] See BOT. GAZETTE **48**:321, 322, 324. 1909.

[5] *Chytridium brassicae* Woronin, M. (see pp. 556–558. *pl. 31. figs. 12–18*) in *Plasmodiophora brassicae*, Urheber der Kohlpflanzen-Hernie. Jahrb. Wiss. Bot. **11**:549–574. *pls. 29–34.* 1878.

[6] DANGEARD, P., Ann. Sci. Nat. Bot. VII. **4**:285, 327. 1886.

[7] *Chytridium* (*Olpidium*) *simulans* DeBary and Wor. (see p. 29. *pl. 2. figs. 11–16*), Beitrag zur Kenntniss der Chytridieen. Ber. Naturf. Ges. Freiburg **3**:Heft 2 (1–40 of separate). *pl. 1.* 1863.

[8] Rabenh., Krypt. Fl. Pilze **4**:29. 1892.

[9] ENGLER AND PRANTL, Pflanzenfam. **1**^{1}:70. 1889.

[10] *Synchytrium trifolii* Pass. in Rab. Fung. Europ. 2419. 1877.

[11] COHN'S Krypt. Fl. Schles. Pilze **1**:181. 1889; and ENGLER und PRANTL, Pflanzenf. **1**^{1}:68. 1889.

[12] Rabenh., Krypt. Fl. Pilze **4**:51. 1892.

[13] FISCH, CARL, Beitrag zur Kenntniss der Chytridiaceen. pp. 48. *pl. 1.* Erlangen. 1884.

[14] SCHUSTER, J., Ueber die Morphologie der Grasblüte. Flora **100**:213–266. *pls. 2–5. figs. 35.* 1910.

From a phylogenetic standpoint he considers the grasses to have descended from lily-like plants in which there were six perianth divisions in two circles, six stamens, and a tricarpellate pistil. Among existing grass genera he places Streptochaeta as most primitive. In this genus there are three stigmas, six stamens, three inner and two outer organs which the author interprets as representing the inner perianth and the posterior segments of the outer perianth, all in the axil of the flowering glume or lemma. In the majority of grasses the floret, borne in the axil of the lemma, consists of a two-keeled palea, three stamens, two lodicules, and a pistil with a two-parted style. HACKEL and others have considered the palea to represent the prophyllum, an organ found at the base of a branch, between that and the main stem. SCHUSTER states, however, that the palea is formed by the union of the two posterior segments of the outer perianth circle of the primitive flower. The inner perianth circle is well developed in Streptochaeta, but is usually reduced to small organs, the lodicules, which commonly function as spreaders during anthesis. The swelling of the lodicules pries open the lemma, thus exposing the stamens and stigmas. Usually there are present only two lodicules, the posterior being absent, but in bamboos and some other grasses all three are present. In the more primitive forms, such as bamboos, there are six stamens, but in most grasses three are suppressed, while more rarely only one or two are present. He accounts for the numerous stamens of certain genera, such as Pariana and Luzuola, by the splitting up of the original six stamens. The pistil consists of three carpels, but the anterior carpel usually fails to produce a style branch.

Recently the morphology of the glumes of Elymus and Hordeum were investigated by SCHENCK,[15] who considered the glumes to be developed from lateral branches at the base of the spikelet. SCHUSTER controverts this, and states that the lower or outer glume originates as a single organ, but soon divides into two portions which stand side by side below the spikelet, the upper glume being suppressed. In certain species of Elymus, such as *E. arenarius*, the glumes are in nearly normal position, for which reason the author follows HOCHSTETTER[16] in separating this group under the genus name Leymus. The author further states that in the end spikelets of the spikes in Elymus and Hordeum, the glumes develop normally, that is, both are present and entire.

Concerning viviparous grasses, it was found that the bulblet-bearing character was more or less constantly inherited, but that by culture in a dry and nitrogen-poor substratum, these forms tended to revert to the normal seed-bearing state.—A. S. HITCHCOCK.

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[15] ENGLER'S Jahrb. **40**:97–113. 1907.

[16] Flora **31**:118. 1848.